Practicum 5: Faecal Studies

Introduction

The elimination from the body of waste products of digestion is essential to health. These excreted waste products are known as *stool* or *faeces*. Stool examination is often done in the evaluation of gastrointestinal disorders, and results are helpful in detecting gastro intestinal bleeding and obstruction, obstructive jaundice, parasitic disease, dysentery, ulcerative colitis, and increased fat excretion.

An adult excretes 100 to 300g of faecal matter a day, and of this as much as 70% may be water. The faeces are what remains of the 8 to 10 litres of fluid that enter the intestinal tract each day. Food and fluid taken orally, saliva, gastric secretions, pancreatic juice, and bile contribute to the formation of faeces.

Faeces are composed of:

1. Waste residue of indigestible material such as cellulose in food eaten over the previous 4 days
2. Bile (pigments and salts); colour is normally due to bile pigments that have been altered somewhat by bacterial action
3. Intestinal secretions, including mucus
4. Leukocytes that migrate from the bloodstream
5. Shed epithelial cells
6. Large numbers of bacteria that make up to one third of total solids
7. Inorganic material (10% - 20%) that is chiefly calcium and phosphates
8. Undigested or unabsorbed food (present in very small quantities).

The output of faeces depends on a complex series of absorptive, secretory and fermentative processes. Normal function of the colon involves three physiologic processes: (1) absorption of fluid and electrolytes (2) contraction that churn the contents, expose contents to the mucosa and transport the contents to the rectum, and (3) defaecation.

Normally evacuated faeces reflect the shape and calibre of the colonic lumen. The normal consistency is somewhat plastic, neither fluid, mushy, nor hard; the usual brown colour results from bacterial degradation of bile pigments; the odour is produced by indole, skatole, and butyric acid. Degradation of undigested protein produces a foul odour, as does excessive carbohydrate ingestion.

Appearance

Stool examination should include size, shape, consistency, colour, odour and presence or absence of blood, mucus, pus, tissue fragments, food residues, bacteria or parasites.

Random collection of stool specimens

Stool specimens are sometimes analyzed for diagnostic purposes. Some of the more frequently ordered tests on faeces are tests for blood bile, parasites and parasite eggs (ova).

Objectives

To conduct a macroscopic and microscopic examination of stool/faeces in order to study the physical, chemical and biological characteristics of faeces.

Materials

- Stool (fresh) specimen
- Stool (faeces) specimen collection containers
- Sieves
- Microscope glass slides
- Microscope
- Disposable wooden spatula (wire loop or applicator sticks, matchsticks, toothpicks)
- Saline solution
- Pens or markers for labelling
- Wax pencil
- Droppers for saline
- Iodine

Procedure

1. Ensure that you have the following items for stool collection:
   - a waxed cardboard box with an overlapping lid, or a plastic cup or box with a tight-fitting lid
   - 2 applicators sticks

2. Pass the stool specimen directly into the container or pass the stool on to a piece of paper and use the applicator sticks to transfer to a container.

3. The container with the specimen should be labelled clearly with the following information:
   - identification number
   - date of collection
   - time of collection

4. The stool specimen must be large enough for satisfactory examination. It should be about the size of a pigeon egg or not less than one gram.

<u>Examination</u>

Macroscopic

1. As soon as the specimen is received in the laboratory, check the consistency (degree of moisture) and write one of the following letters on the container: F(formed), S (soft), L (looses) or W (watery).

If mucus is present write M, and if blood is present write B. For example, a loose stool with blood and mucus would be recorded as L, B, M.

2. Examine the stool specimen for the following characteristics: colour, odour, shape, pus, parasites.

Microscopic Examination

1. A wet mount can be prepared directly from faecal material or from concentrated specimens. The basic types of wet mount that should be used for each faecal examination are saline, iodine.

   - The *saline wet mount* is used for the initial microscopic examination of stools. It is employed primarily to demonstrate worm eggs, larvae, protozoan trophozoites and cysts. This type of mount can also reveal the presence of red blood cells and white blood cells.

   - The *iodine wet mount* is used mainly to stain glycogen and the nuclei of cysts, if present. Cysts can usually be specifically identified in this mount.

2. Place a drop of saline in the centre of the left half of the slide and place a drop of iodine solution in the centre of the right half of the slide.

FAECAL STUDIES: TESTS RESULTS

Table 1: Macroscopic

Characteristic	**Normal**	**Observed**
Colour	Brown	
Odour	Varies	
Consistency	Plastic	
Size, shape	Formed	
Blood	None	
Pus	None	
Parasites	None	

Table 2: Microscopic

Characteristic	**Normal**	**Observed**
Yeasts	None	
Eggs + segments of parasites	None	
RBC	None	
WBC	None	
Undigested food	None to small amount	

REFERENCES

1. Fischbach – Laboratory and Diagnostics Tests
2. WHO – Basic Laboratory method in Medical Parasitology

Practicum 6: Histological Studies of the Gastrointestinal tract

Introduction

An understanding of the basic structure of the Gastrointestinal tract is fundamental to the study of the anatomy and physiology of the digestive system. The GI tract is basically a tube with a wall having four different layers. Each layer has certain components which vary in the different segments along the GI tract. This variation is related to function and aids in the identification of each segment.

It is important to keep in mind this scheme as one studies the GI tract anatomy. Each segment of the GI tract has regional anatomical features which are specifically related to its function.

Objectives

1. To identify the four different layers that form the GI tract wall
2. To examine the components of the different layers of the GI tract wall
3. To distinguish the segments of the GI tract from each other based on their characteristics.
4. To relate the histology of each segment of the GI tract to its specific function.

Materials

Prepared slides and models of:
- taste buds, teeth, tongue
- salivary glands
- oesophagus
- stomach
- duodenum, jejunum and ileum
- colon
- appendix
- anal canal
- tooth embryology
- liver, pancreas

Procedure

Make a systematic histological study of the organs of the digestive system using the Histology Atlas for reference.

MICROSCOPIC ANATOMY OF THE DIGESTIVE SYSTEM

A. Oral Cavity

Use the microscope slides of TONGUE, and the TOOTH MODEL.

1. ***Tongue***. Distinguish the following papillae

   a) Filiform: the most numerous, slender and tapering to a tip which is usually keratinised (filum=thread).

   b) Fungiform: less numerous but larger than filiform; having flattened tops (fungiform = mushroom shaped); epithelium may have taste buds.

   c) Vallate: flattened on top but much larger than fungiform; each surrounded by a circular trench (valley), the epithelium of which contains taste buds.

2. ***Tooth***. Distinguish divisions and components:

   a) divisions
      i) crown
      ii) neck
      iii) root

   b) Components
      i) dentine
      ii) enamel
      iii) cementum
      iv) periodontal membrane
      v) pulp and pulp cavity

3. ***Salivary Glands***. Find the secretory portions and ducts on your slide of SALIVARY GLAND. You will not have to distinguish between types of salivary glands, but should be able to distinguish them from the other digestive glands studied.

B. Gastrointestinal Tract

1. General Scheme. The GI tract is basically a tube with a wall having four different layers. Each layer has certain components which vary in the different segments along the GI tract. This variation is related to function and

aids in the identification of each segment. Use the scheme presented below to study the slides of the GI tract.

a) tunica (t.) mucosa, the innermost layer consisting of three parts:
   i) epithelium – lining the lumen of the GI tract
   ii) lamina propria – loose connective tissue containing vessels, glands and lymphatics
   iii) muscularis mucosae – thin layer of smooth muscle cells

b) tunica submucosa – connective tissue containing larger vessels, glands in certain regions and lymphatics.

c) the tunica muscularis – is primarily smooth muscle, usually arranged in two layers, the innermost having smooth muscle cells arranged in a circular pattern around the tube and the outer layer having smooth muscle cells arranged in a longitudinal pattern to the tube.

d) tunica serosa or adventitia – outermost layer of the GI tract:
   i) Serosa – connective tissue with a distinct outer covering of simple squamous epithelium
   ii) adventitia – connective tissue only, attaching the segment to adjacent structures.

2. General Characteristics. Study the MICROSCOPE SLIDE from each segment of the GI tract and identify the features or layers listed with it. Be able to distinguish these segments from each other based on these characteristics.

a) **Oesophagus**
   i) stratified squamous epithelium (function?)
   ii) submucous glands (functions?)
   iii) t. muscularis. What type(s) of muscle tissue is/are seen? Is this cross section from the upper, middle, or lower oesophagus?

b) **Stomach**

   i) Simple columnar epithelium (with goblet cells): invaginated into gastric pits, into which many long tubular gastric glands empty their secretions (of what?).
   ii) muscularis mucosae – border of t. mucosa

   iii) t. submucosa – thicker areas or this layer constitute rugae (seen without microscope).

   iv) t. muscularis – very thick in the stomach (why?); look for three (not just two) layers.

c) **Small Intestine – Slide and Model**

   i) simple columnar epithelium (with goblet cells):
   - cover finger-like villi projecting into the opening of the

intestine (function?)
- microvilli, seen only as a thin surface border on epithelial cells (function?)
- a lacteal in the axis of each villus (function?)
- intestinal crypts (glands), invaginations into the intestinal wall between villi

ii) t. muscularis – note orientation of smooth muscle in two layers.

d) **Colon**

i) simple columnar epithelium (with many goblet cells):
- microvillous border seen
- invaginated as simple tubular crypts

ii) muscularis mucosae

iii) t. muscularis

C. Liver and Pancreas

1. **Liver**. Each lobe of the liver is divided into roughly hexagonal lobules formed by radically arranged cords or plates of hepatocytes (liver cells). Look for lobules with the unaided eye on your microscope slide of LIVER. Then use the microscope to identify the following:

a) lobule
b) central vein
c) a triad and its three components (more than one of each may be present):

i) a branch of the portal vein
ii) a branch of the hepatic artery (an arteriole)
iii) a branch of the bile duct, lined by simple cuboidal epithelium

d) sinusoids thin walled vessels draining toward the central vein
e) hepatocytes, the main cell type in the liver, cuboidal in shape
f) extremely small bile canaliculi carrying bile between hepatocytes toward the branches of the bile duct.

2. The **pancreas** is composed of two distinct types of glandular tissue. The main mass of tissue is the exocrine part of the pancreas; embedded within this tissue are clusters of endocrine cells constituting the islets of Langerhans (pancreatic islets). Use your microscope slide of PANCREAS to identify:

a) pancreas (exocrine part)
b) islets of Langerhans (endocrine)

REVIEW EXERCISE

A. On the drawing of the gastrointestinal tract, label the following:

1. Oropharynx
2. Oesophagus
3. Stomach
4. Small intestines
5. Large intestines
    a) cecum; ascending, transverse, descending and sigmoid colon; and rectum
    b) taeniae coli and haustra
6. Liver

B. On the drawing of the accessory glands (upper drawing) label the following:

1. Livers and gallbladder
2. Pancreas
3. Duodenum
4. Stomach: greater and lesser curvatures
5. Spleen
6. Arteries
    a) celiac: splenic, left gastric and hepatic
    b) superior mesenteric

C. On the drawing of the biliary apparatus (lower drawing) label the following:

1. Hepatic ducts
2. Common hepatic duct
3. Cystic duct and gallbladder
4. Pancreas
5. Duodenum
6. Common bile duct

REFERENCES

1. Atkin J, Haersma, J (1983). Basic Human Anatomy A215 Laboratory and Study Guide. Indiana University.

2. Benson, H J, Gunsteram S E, Talaro, A and Talaro K P (1995). Anatomy and Physiology 6th ed., WCB McGraw Hill, Boston.